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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
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10/731,481

12/10/2003

Ui Sik Kim

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01/25/2005

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EXAMINER

LINDSAY JR, WALTER LEE

ART UNIT

PAPER NUMBER

2812

DATE MAILED: 01/25/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

10/731,481

Applicant(s)

KIM, UI SIK

Examiner

Walter L. Lindsay, Jr.

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☐ Responsive to communication(s) filed on ____.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-8 is/are pending in the application.
- 4a) Of the above claim(s) ____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) ____ is/are allowed.
- 6) ☒ Claim(s) 1-4 and 8 is/are rejected.
- 7) ☒ Claim(s) 5-7 is/are objected to.
- 8) ☐ Claim(s) ____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on ____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All b) ☐ Some * c) ☐ None of:
1. ☒ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. ____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☒ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date 12/10/2003.
- 4) ☐ Interview Summary (PTO-413)
Paper No(s)/Mail Date. ____.
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: ____.

DETAILED ACTION

This Office Action is in response to an Application filed 12/10/2003.

Currently, claims 1-8 are pending.

Specification

1. The specification has not been checked to the extent necessary to determine the presence of all possible minor errors. Applicant's cooperation is requested in correcting any errors of which applicant may become aware in the specification.
2. The disclosure is objected to because of the following informalities: In Paragraph [0023] "normal temperature" is not properly defined. The examiner does not have a reference to what the Applicant considers "normal" from the reading of the specification. It is assumed that the applicant means room temperature or the initial temperature of the heated furnace but without further definition of what the term "normal temperature" means this important information cannot be determined.

Appropriate correction is required.

Claim Rejections - 35 USC § 112

3. The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.
4. Claims 2 and 4 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.
5. The term "Normal temperature" in claims 2 and 4 is a relative term which renders the claim indefinite. The term "normal temperature" is not defined by the claim, the

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specification does not provide a standard for ascertaining the requisite degree, and one of ordinary skill in the art would not be reasonably apprised of the scope of the invention. As stated above normal temperature is not defined in the specification as to whether it is meant in relationship to room temperature or the initial temperature of the furnace.

Claim Rejections - 35 USC § 103

6. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

7. The factual inquiries set forth in *Graham v. John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

8. Claims 1, 3 and 8 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kwon et al. (U.S. Patent No. 6,815,275 filed 9/27/2002) in view of Dass et al. (U.S. Patent No. 5,536,684 dated 7/16/1996) and Mikagi (U.S. Patent No. 6,284,662 dated 9/4/2001).

Kwon shows the method substantially as claimed in Figs. 3A-5 and corresponding text as: forming a gate (109) on a predetermined area of a semiconductor substrate (100) (col. 3, line 56-col. 4, line 8), forming spacers (110a, 112a) on sidewalls thereof (col. 4, lines 9-29), and then forming a junction area (114) in a predetermined area of the semiconductor substrate (col. 4, lines 9-29); forming a cobalt film (116) and a buffer layer (120) on the whole structure (col. 4, lines 30-65); forming a cobalt mono-silicide film (normally depicted as (Co_xSi_y)) on the gate and the junction area, by performing a first RTP process (col. 4, lines 30-40); making a surface of the cobalt mono-silicide film amorphous to form an amorphous cobalt silicide film (col. 4, lines 30-40); and forming a cobalt di-silicide (CoSi_2), by removing the non-reacting cobalt film (col. 4, lines 30-40) and then performing a second RTP process (col. 4, line 67-col. 5 line 23) (claim 1). Kwon shows the method substantially as claimed in Figs. 3A-5 and corresponding text as: forming a gate (109) on a predetermined area of a semiconductor substrate (100) (col. 3, line 56-col. 4, line 8), forming spacers (110a, 112a) on sidewalls thereof (col. 4, lines 9-29), and then forming a junction area (114) in a predetermined area of the semiconductor substrate (col. 4, lines 9-29); forming an insulating film (110, 112) on the whole structure and then removing the insulating film on an area in which a silicide film should be formed (Figs. 3A-3B) (col. 3, line 56-col. 4 line 29); making the cobalt film (116) react with the gate and the junction area from which the insulating film is removed and exposed, to form a cobalt mono-silicide film, by performing a first RTP process (col. 4, lines 30-40); making a surface of the cobalt mono-silicide film amorphous to form an amorphous cobalt silicide film (col. 4, lines 30-

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40); and forming a cobalt di-silicide film by removing the non-reacting cobalt film (col. 4, lines 30-40) and then performing a second RTP process (col. 4, line 67-col. 5 line 23) (claim 8).

Kwon lacks anticipation in not explicitly teaching the steps of: 1) making a surface of the cobalt mono-silicide film amorphous to form an amorphous cobalt silicide, by performing a carbon ion implanting process; and forming a cobalt di-silicide film, by removing the non-reacting cobalt film and the buffer layer and then performing a second RTP process (claim 1); 2) forming the buffer layer of TiN film (claim 3); and 3) making a surface of the cobalt mono-silicide film amorphous to form an amorphous cobalt silicide, by performing a carbon ion implanting process; and forming a cobalt di-silicide film, by removing the non-reacting cobalt film and the TiN film and then performing a second RTP process (claim 8).

Dass teaches the formation of a cobalt silicide layer. In fig. 4 Dass shows a cobalt silicide layer (13) formed on a silicon substrate (10) with TiN film (placed on top of the cobalt silicide layer (col. 4, lines 28-43). Then the TiN layer is chemically removed from the top of the cobalt silicide (col. 4, lines 44-57). In figure 6 an ion implantation step is carried out which lead to an amorphized cobalt silicide layer. Any ion (such as carbon) able to cause the growth of an amorphous cobalt silicide layer can be used, during the ion implantation of the cobalt silicide (col. 4, line 58-col. 5, line 8). Then the substrate undergoes a second RTP process carried out with inert gases in a nitrogen ambient. The cobalt atoms aid in the formation of shallow junctions do to the fact that cobalt does not form tightly bonded compounds with boron or arsenic two

widely used dopant ions (col. 1, lines 56-65). Additionally, the process helps to reduce source/drain resistance.

Mikagi deals with the formation of a cobalt silicide layer. In the discussion of how to form a low resistance cobalt silicide it is discussed how the implantation of carbon inhibits the proper growth of the low resistance cobalt silicide layer and cause the layer to take on amorphous characteristics (col. 2, lines 20-49).

It would have been obvious to one of ordinary skill in the art, at the time the invention was made, to modify the method shown in Kwon by forming the amorphous cobalt by implanting carbon, and forming the cobalt di-silicide layer by removing a buffer layer made of TiN and then introducing the substrate to a RTP process as taught by Dass and the teachings of Mikagi with the motivation that Dass forms a cobalt silicide layer that aids in the formation of shallow junctions do to the fact that cobalt doesn't form tight bonded compounds with boron and arsenic and also reduces source/drain resistance.

Allowable Subject Matter

9. Claims 5-7 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

10. The following is a statement of reasons for the indication of allowable subject matter: the prior art, either singly or in combination fails to anticipate or render obvious, the limitations of:

...the first RTP process is performed at a temperature of 430°C to 530°C for a time of 10 to 60 seconds, by introducing nitrogen gas, argon gas, helium gas and hydrogen gas at a flow rate of 10 to 1000 sccm, respectively, as required by claim 5;

...the carbon ion implanting process is performed up to a depth of 50 Å to 1000 Å with an energy of 10 to 100 keV and a dose of 1×10^{14} to 1×10^{16} atoms/cm², as required by claim 6; and

... the second RTP process is performed at a temperature of 650°C to 800°C for a time of 5 to 30 seconds, by introducing nitrogen gas, argon gas, helium gas and hydrogen gas at a flow rate of 10 to 1000 sccm, respectively, as required by claim 7.

11. Claims 2 and 4 would be allowable if rewritten to overcome the rejection(s) under 35 U.S.C. 112, 2nd paragraph, set forth in this Office action and to include all of the limitations of the base claim and any intervening claims.

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Walter L. Lindsay, Jr. whose telephone number is (571) 272-1674. The examiner can normally be reached on Monday-Thursday.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Michael S. Lebentritt can be reached on (571) 272-1873. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

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Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

Walter L. Lindsay, Jr.
Examiner
Art Unit 2812

WLL

January 19, 2005

